CLAIMS

Sub a1

1. A method of determining a respective process value of at least one input variable governing a plasma process sequence for creating a desired surface profile on a process substrate, the method comprising the steps of:

a. selecting a respective test value of the at least one input variable;

b. subjecting a test substrate to a test process defined by the respective test value, thereby creating a test surface profile;

c. providing an initial surface profile model in terms of the at least one input variable and at least one unknown coefficient;

d. generating an approximate profile prediction from the initial surface profile model and the respective test value of the at least one input variable;

e. generating an indicator of difference between the test surface profile and the approximate profile prediction;

f. generating a respective optimum value of the at least one unknown coefficient that minimizes the indicator of difference;

g. modifying the initial surface profile model to include the at least one optimum value, thereby providing a final model in terms of the at least one input variable; and

h. generating the respective process value of the at least one input variable from the final model and the desired surface profile.

2. The method of claim 1 wherein the at least one unknown coefficient comprises a plurality of unknown coefficients.

3. The method of claim 1 wherein the at least one input variable comprises a plurality of input variables, the approximate profile prediction being generated from the initial surface profile model and the respective test values of each of the plurality of input variables.

4. The method of claim 1 wherein the test surface profile comprises a plurality of snapshots, the approximate profile prediction including a frame corresponding to each snapshot, the step of generating an indicator of difference between the test surface profile and the approximate profile prediction including pairwise comparison of each snapshot with the respective corresponding frame.

5. The method of claim 1 wherein generating an approximate profile prediction includes using a respective rough preliminary value of the at least one unknown coefficient.

Sub a2

6. The method of claim 35 wherein generating a respective optimum value of the at least one unknown coefficient includes changing at least one of said at least one respective rough preliminary value of the at least one unknown coefficient and comparing the test surface profile and the approximate profile prediction incorporating the at least one changed value.

7. The method of claim 1 wherein the indicator of difference is generated by a multidimensional nonlinear least-squares technique.

8. A method of processing a process substrate to create a desired surface profile thereon, the process comprising the step of applying a plasma process to the process substrate, the plasma process being defined by the respective process value of the at least one input variable determined by the method of claim 1.

~~9. A device made by processing a process substrate as defined in claim 4.~~

Sub a3

10. A method of predictively calculating a process surface profile to be created on a process substrate by a plasma process sequence defined by a respective process value of at least one input variable, the method comprising the steps of:

a. selecting a respective test value of the at least one input variable, at least one of said at least one respective test value being unequal to at least one of said at least one respective process value;

b. subjecting a test substrate to a test process defined by the respective test value, thereby creating a test surface profile;

c. providing an initial surface profile model in terms of the at least one input variable and at least one unknown coefficient;

d. generating an approximate profile prediction from the initial surface profile model and the respective test value of the at least one input variable;

e. generating an indicator of difference between the test surface profile and the approximate profile prediction;

f. generating a respective optimum value of the at least one unknown coefficient that minimizes the indicator of difference;

g. modifying the initial surface profile model to include the at least one optimum value, thereby providing a final model in terms of the at least one input variable; and

h. introducing the respective process value of the at least one input variable into the final model, thereby forming a description of the process surface profile.

11. The method of claim 10 wherein the at least one unknown coefficient comprises a plurality of unknown coefficients.

12. The method of claim 10 wherein the at least one input variable comprises a plurality of input variables, the approximate profile prediction being generated from the initial surface profile model and the respective test values of each of the plurality of input variables.

13. The method of claim 10 wherein the test surface profile comprises a plurality of snapshots, the approximate profile description including a frame corresponding to each snapshot, the step of generating an indicator of difference between the test surface profile

and the approximate profile description including pairwise comparison of each snapshot with the respective corresponding frame.

14. The method of claim 10 wherein generating an approximate profile description includes using a respective rough preliminary value of the at least one unknown coefficient.

15. The method of claim 14 wherein generating a respective optimum value of the at least one unknown coefficient includes changing at least one of said at least one respective rough preliminary value of the at least one unknown coefficient and comparing the test surface profile and the approximate profile prediction incorporating the at least one changed value.

16. The method of claim 10 wherein the indicator of difference is generated by a multidimensional nonlinear least-squares technique.

17. The method of claim 10 wherein the respective process value of the at least one input variable varies with time.

Sub A4

18. A method of configuring an apparatus for processing a process substrate according to a plasma process sequence defined by a respective process value of at least one input variable, the apparatus including a plasma reactor, the at least one input variable including at least one reaction variable, the method comprising the steps of:

a. selecting a respective test value of the at least one input variable;

b. subjecting a test substrate to a test process defined by the respective test value, thereby creating a test surface profile;

c. providing an initial surface profile model in terms of the at least one input variable and at least one unknown coefficient;

d. generating an approximate profile prediction from the initial surface profile model and the respective test value of the at least one input variable;

e. generating an indicator of difference between the test surface profile and the approximate profile prediction;

f. generating a respective optimum value of the at least one unknown coefficient that minimizes the indicator of difference;

g. modifying the initial surface profile model to include the at least one optimum value, thereby providing a final model in terms of the at least one input variable;

h. generating the respective process value of the at least one input variable from the final model and the desired surface profile; and

i. configuring the reactor to process the process substrate according to the derived respective process value of the at least one reaction variable.

19. An apparatus for determining a respective process value of at least one input variable governing a plasma process sequence for creating a desired surface profile on a process substrate, the apparatus comprising:

a. a computer memory for storing the desired surface profile;

b. a computer memory for storing a test surface profile, created by subjecting a test substrate to a test process defined by a respective test value of the at least one input variable;

c. means for generating an initial surface profile model in terms of the at least one input variable and at least one unknown coefficient;

d. means for generating an approximate profile description from the initial surface profile model and the respective test value of the at least one input variable;

e. means for generating an indicator of difference between the test surface profile and the approximate profile prediction;

f. means for generating a respective optimum value of the at least one unknown coefficient that minimizes the indicator of difference;

g. means for modifying the initial surface profile model to include the at least one optimum value, thereby providing a final model in terms of the at least one input variable; and

h. means for generating the respective process value of the at least one input variable from the final model and the desired surface profile.

20. The apparatus of claim 19 wherein the test surface profile comprises a plurality of snapshots, the approximate profile prediction including a frame corresponding to each snapshot, the means for generating an indicator of difference between the test surface profile and the approximate profile prediction being configured so as to compare each snapshot with the respective corresponding frame.

21. The apparatus of claim 19 further comprising a computer memory for storing a respective rough preliminary value of the at least one unknown coefficient, the means for generating an approximate profile description from the initial surface profile model and the respective test value of the at least one input variable employing the respective rough preliminary value.

22. The method of claim 21 wherein the means for generating a respective optimum value of the at least one unknown coefficient is configured to change at least one of said at least one respective rough preliminary value of the at least one unknown coefficient and to compare the test surface profile and the approximate profile prediction incorporating the at least one changed value.

23. The method of claim 19 wherein the means for generating an indicator of difference between the test surface profile and the approximate profile prediction employs a multidimensional nonlinear least-squares technique.

Sub a5

24. An apparatus for predictively calculating a process surface profile to be created on a process substrate by a plasma process sequence defined by a respective process value of at least one input variable, the method comprising the steps of:

a. a computer memory for storing the respective process value;

b. a computer memory for storing a test surface profile, created by subjecting a test substrate to a test process defined by a respective test value of the at least one input variable;

c. means for generating an initial surface profile model in terms of the at least one input variable and at least one unknown coefficient;

d. means for generating an approximate profile prediction from the initial model and the respective test value of the at least one input variable;

e. means for generating an indicator of difference between the test surface profile and the approximate profile prediction;

f. means for generating a respective optimum value of the at least one unknown coefficient that minimizes the indicator of difference;

g. means for modifying the initial surface profile model to include the at least one optimum value, thereby providing a final model in terms of the at least one input variable; and

h. means for introducing the respective process value of the at least one input variable into the final model, thereby forming a description of the process surface profile.

25. The apparatus of claim 24 wherein the test surface profile comprises a plurality of snapshots, the approximate profile prediction including a prediction corresponding to each snapshot, the means for generating an indicator of difference between the test surface profile and the approximate profile prediction being configured so as to compare each snapshot with the respective corresponding prediction.

26. The apparatus of claim 24 further comprising a computer memory for storing a respective rough preliminary value of the at least one unknown coefficient, the means for

generating an approximate profile prediction employing the respective rough preliminary value.

27. The method of claim 26 wherein the means for generating a respective optimum value of the at least one unknown coefficient is configured to change at least one of said at least one respective rough preliminary value of the at least one unknown coefficient and to compare the test surface profile and the approximate profile prediction incorporating the at least one changed value.

28. The method of claim 24 wherein the means for generating an indicator of difference between the test surface profile and the approximate profile prediction employs a multidimensional nonlinear least-squares technique.

29. The method of claim 1 further comprising the step of applying a plasma process to the process substrate, the plasma process being defined by the respective process value of the at least one input variable.